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Time Dependent Valuation (TDV) HVAC System Performance (Res & Nonres)

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Time Dependent Valuation (TDV) - HVAC System Performance (Res & Nonres)

Description

Time Dependent Valuation (TDV) will allow the Title 24 standards (both residential and nonresidential) to distinguish between a piece of HVAC equipment that performs well during on-peak conditions and a different piece that does not. Under the current standards, default equipment performance assumptions are used in most situations, for both base case and proposed equipment. If they have the same SEER rating, they are deemed to be equally efficient. This practice ignores the differences in performance among similar equipment offerings by different manufacturers. It is clear from the CEC's database of air conditioner efficiencies that, for units with a given SEER, there is a wide range in EERs. Yet EER is a better measure of peak load performance. Under current standards, this is ignored, so there is no incentive for building designers to specify equipment that performs better under peak conditions.

The TDV proposal for HVAC system performance would allow designers to specify the performance curves for the actual HVAC units they have selected. These curves describe, as a function of outdoor temperature, the efficiency and the capacity of the unit. The performance curves for the proposed equipment would be specified by the designer in terms of manufacturers' published performance data; it would be entered into the compliance software program, which would then execute a curve fit to derive the performance curves. There would also be revised base case performance curves against which the proposed equipment performance would be compared. The base case performance curves would be developed from the CEC's Appliance Directories of equipment, and would be based on the 50^{th} percentile of equipment performance (i.e., the base case would assume equipment with an ordinary level of performance).

Users would actually be given three choices for specifying the performance of their equipment:

1. If the user specifies a particular make and model of HVAC unit, then s/he would enter the actual performance data for that unit. This data takes the form of four data points each for the two performance curves (capacity, efficiency vs. temperature). The builder would then be constrained to install that particular unit in the building; else compliance would have to be re-computed for the replacement unit.
2. If the user specifies only the SEER and the EER of the HVAC unit, then a default set of performance curves would be used, based on EER performance. The builder would then be constrained to install an HVAC unit that meets both the SEER and EER performance criteria; else compliance would have to be re-computed for the replacement unit.
3. If the user specifies only the SEER (or EER as required by the Standards), then a minimally compliant default set of performance curves would be used, based on the SEER and the 15th percentile of performance (i.e., a poorly performing unit would be assumed). The builder would then be able to install any HVAC unit that meets the minimum requirements of the Standards.

Benefits

This proposal will signal building designers to choose HVAC equipment that performs better under peak conditions, and will encourage manufacturers to produce more of those models. Building owners will see reduced energy and demand costs. As with other TDV supported measures, the long term benefits will extend to the state through reduced peak system demand and a reduced need to build additional power plants and transmission/distribution lines.

Environmental Impact

TDV will likely produce long term reductions in on-peak power plant emissions by reducing peak demands from HVAC systems. This measure will also encourage such peak demand reduction strategies as gas cooling, but only to the extent these technologies are viable in the marketplace. Other than these, we do not foresee any major changes in environmental factors resulting from adoption of TDV.

Type of Change

This way of characterizing HVAC equipment performance would apply to both residential and nonresidential standards (see related measure to implement hourly HVAC equipment models in the residential standards). The basic HVAC equipment efficiency requirements (SEER) would not be changed by this proposal, but the differences in equipment performance would be recognized as optional measures throughout the standards.

The prescriptive approach would only be affected to the extent that different packages of measures are adopted based on assumed HVAC equipment performance. The basic package would be based on minimally efficient equipment (meets SEER, 15th percentile EER and performance curves). Other packages could be developed that require equipment with better on-peak performance.

The performance approach would implement the three alternative approaches described above. Trade-offs among building measures could acknowledge better or worse performing HVAC units.

Adoption of this HVAC equipment performance approach would require substantial modifications to the ACM Manual and the compliance programs. The most substantial changes would be to the residential analysis methods, which would change from annual performance of measures to hourly performance (e.g. hour-by-hour HVAC equipment models and water heating usage). These changes are the subject of companion code change proposals prepared by the TDV development team. The Manuals would need some additional material to explain the concepts and consequences of TDV to designers and the compliance community. Exceptional methods would need to be updated to account for the hourly analysis methods of this proposal.

Measure Availability and Cost

Because it is not a single measure or piece of hardware, measure availability and cost does not apply directly to this HVAC performance method. To the extent models or types of equipment become more highly valued under TDV than they currently are valued, these changes could affect their availability and cost in the market. The CEC Appliance Directories already contain data that indicate substantial numbers of available

makes/models of better performing equipment. Based on past experience, we would expect the cost of higher performance equipment to come down over time as it becomes more widely available.

Useful Life, Persistence and Maintenance

Because it is not a single measure or piece of hardware, useful life, persistence and maintenance do not apply directly to this HVAC performance proposal. Some of the mechanisms used by manufacturers to achieve better on-peak performance with their HVAC equipment may be more or less persistent or may require different kinds of maintenance, but this is difficult to assess, given the fluid nature of the HVAC market.

Performance Verification

This measure will require that builders install HVAC units with the correct performance characteristics (unless minimally compliant equipment is assumed). Building officials will be called upon to verify that specified equipment is actually installed. Beyond that, there should be no special performance verification required.

Cost Effectiveness

This approach to crediting HVAC equipment performance is not fundamentally a cost-effectiveness question. It simply allows the Standards to distinguish more accurately between differently performing units. If there are questions raised about setting the default performance levels for unspecified make/model to the 15th percentile, there may need to be some cost effectiveness investigation to justify that level.

Analysis Tools

For the nonresidential standards, the existing compliance tool, DOE-2, already has the needed curve fitting capabilities to derive the performance curves from manufacturers' data. All that is needed for the nonresidential compliance tool is to ask for and accept the data points needed to do the curve fit.

For the residential standards, the existing compliance tools need to be upgraded to include an hourly HVAC equipment model. This would also entail development of a curve fitting capability in order to translate manufacturers' data into performance curves. The TDV project team has developed such a tool in a prototype spreadsheet format.

Relationship to Other Measures

This new approach to HVAC performance would have some interaction with other measures at the whole building level, because high performance HVAC units might provide additional trade-off opportunities with other measures. These kinds of trade-offs, however, have been available for many years, differing only in degree with the trade-off opportunities provided by this proposal.

Bibliography and Other Research

The TDV methodology has been developed over the past several years by a consultant team funded and lead by PG&E, with support and active participation by the CEC staff, Southern California Edison, Southern California Gas Co., and other interested parties.

The results of this analysis has been published in a series of reports, all of which are posted on the TDV Project web site at: www.h-m-g.com/tdv/index.htm.

Key documents available at that location include:

Questions about the TDV methodology may be addressed to:

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